

**A PROGRAM
FOR IMPROVING
MANAGEMENT AND RESEARCH
OF FISHERIES IN THE CENTRAL REGION**



**CENTRAL REGION SONAR DEVELOPMENT
2003 TO 2008**

PROJECT BLUE BOOK - 2002

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CENTRAL REGION SONAR DEVELOPMENT 2003 TO 2008

EXECUTIVE SUMMARY

Sustainable management of salmon fisheries in Central Region (region) is highly dependent on the use of sonar to count both adults and juveniles (smolts). Adult salmon sonar counters are located on the Copper, Kenai, Kasilof, Yentna, Crescent, and Nushagak Rivers, primarily to count sockeye salmon. Smolt sonar counters are used on

NEED TO REPLACE BENDIX SONAR COUNTERS

- ✓ Spare parts no longer made
- ✓ Difficult to obtain service in future
- ✓ Data is not reproducible
- ✓ Adult sonar employs fixed counting criteria – lacks flexibility
- ✓ Juvenile sonar cannot adjust for changes in distribution of migrating smolt
- ✓ Juvenile sonar cannot count smolt close to surface

the Kvichak, Egegik, and Ugashik Rivers to count sockeye salmon smolts as they migrate out of the rivers. The production from these nine river systems accounts for over 60% of the statewide sockeye salmon production and contributes significantly to Alaska's economy.

The Department of Fish and Game (department) currently uses Bendix sonar counters designed and manufactured in the 1970's and early 1980s. While these counters have performed admirably for two decades, they are now obsolete and require replacement. Spare parts are no longer made for the counters and service can be provided by only one individual. The counters use fixed counting criteria and were designed specifically for counting sockeye salmon, traits that limit their

flexibility. For these reasons, the department embarked on a process of developing the next generation of sonar counters starting in 1998. Based on the experience gained during initial efforts, Central Region is going forward with the process of replacing the Bendix sonar counters. This process started in FY 2000 with the objective of being completed by FY 2007. Under this plan, all adult and juvenile sonar systems would be fully operational, and used for inseason management, setting escapement goals, or forecasting by FY 2008.

All dollar figures are listed in thousands of dollars. The total cost of replacing the adult salmon counters is approximately \$2,592.4 over the course of the six years. Of this total cost, \$1,001.8 has been obtained, either through previous CIPs or Western Alaska Disaster funds. The remaining \$1,590.6 is

GOALS FOR SONAR TRANSITION

- ✓ Complete the Replacement of Adult Sonar Counters in Six River Systems in Six Years (FY 2002 - FY 2007)
- ✓ Replace Juvenile (Smolt) Sonar Counters in Three River Systems in Six Years (FY 2002 - FY 2007)

currently unfunded. Replacing the three smolt counters is expected to cost \$580.5, of which \$560.7 is currently unfunded. Finally, to further acoustic research, centralize data processing, and maintain the new sonar systems a sonar lab is planned for Upper Cook Inlet located on the banks of the Kenai River, requiring another \$325.0. The department will be seeking CIP funds from the Alaska State Legislature to carry out this replacement.

REPLACEMENT SCHEDULE AND COST

ADULT SALMON COUNTERS

- ✓ Completed by FY 2007
- ✓ Total Cost of \$2,592.4
- ✓ \$1,590.6 to be requested through CIPs

JUVENILE SALMON COUNTERS

- ✓ Completed by FY 2007
- ✓ Total Cost of \$580.5
- ✓ \$560.7 to be requested through CIPs.

KENAI RIVER SONAR CENTER

- ✓ Total Cost of \$325.0 included in FY 2003 CIP request.

Once the replacement is completed the new sonar counters will provide more information than the old Bendix counters, will be usable in a greater variety of counting situations, and should provide service well into the future.

Replacement of the Central Region sonar inventory with up to date equipment is a critical component of improving management and research of salmon fisheries in Central Region. The program for this replacement, as laid out in this document will take from FY 2002 until FY 2008 before the last units are fully operational.

INTRODUCTION

Alaska Department of Fish and Game fishery managers and researchers have used a variety of sonar counting techniques to improve management and understanding of various salmon stocks. In the Central Region (Figure 1), commercial fishery managers have used daily estimates of escapement derived from side-looking sonar to manage sockeye salmon (*Oncorhynchus nerka*) fisheries for over 30 years. Area managers in Prince William Sound (PWS), Upper Cook Inlet (UCI), and Bristol Bay use daily estimates of salmon passage derived from sonar as a primary tool in assessing run strength and timing. Commercial, recreational, and personal use fisheries are managed inseason using this information to ensure that established escapement goals are met. In addition, sonar counts of outmigrating sockeye salmon smolts help forecast returns to major Bristol Bay river systems and help researchers evaluate escapement goals.

Because of the large number of silt laden and glacially occluded rivers in south central Alaska, Central Region staff began working closely with Mr. Al Menin of the Bendix Corporation¹ starting in the late 1960s to develop acoustic salmon counting techniques for both adults and smolts. This program has grown over the last thirty years to include six adult salmon counting sites (one in Bristol Bay, four in Cook Inlet, and one in the Prince William Sound/Copper River area) and three smolt-counting sites in Bristol Bay. Together, these nine river systems account for over 60% of the total statewide production of sockeye salmon. Because of the importance of the sonar program to Central Region, there is a need to replace the existing sonar units while they are still functioning, especially in Upper Cook Inlet where the management program for sockeye salmon rests heavily on Bendix adult salmon sonar counters.

NEED FOR NEW SONAR SYSTEM

The Bendix sonar counters have provided extraordinary service over the last thirty years. They have allowed the department to count sockeye salmon in large silt laden or glacially occluded rivers throughout Central Region where aerial surveys and counting towers are useless and weirs are problematic due to river size, debris load, or boat traffic. They provided the data critical to rebuilding many sockeye runs from their depressed levels of the 1960s and early 1970s. They have repaid the department's initial investment in development many times over.

However, as fishery management has become more complex in Alaska, certain shortcomings of the Bendix sonar system have become more critical. The hourly count produced by the Bendix sonar cannot be reproduced. If problems occur with data collection, there is no way to go back and reassess the count. New sonar technologies can provide information that can help diagnose problems and address uncertainties in

¹ Use of company name does not constitute an endorsement by the department.

Central Region Bendix Sonar Projects

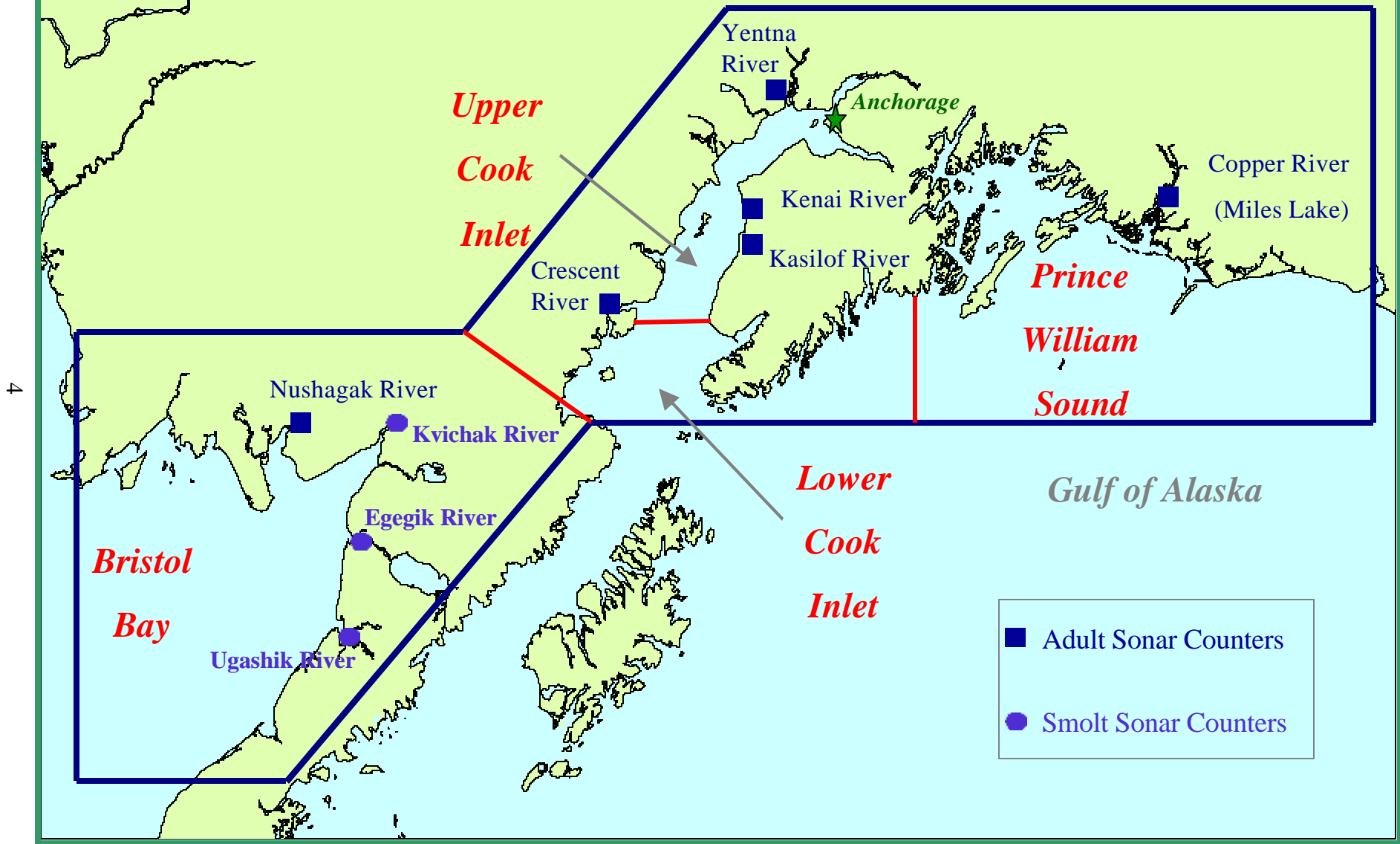


Figure 1. Central Region Bendix sonar projects.

data that may arise, are more versatile, sample longer ranges, and distinguish between upstream and downstream targets. The department needs sonar systems that will meet the increasing demands of fishery management over the next twenty to thirty years and have the ability to adopt counting criteria to conform to a wide variety of species and counting locations.

Initial studies of sonar technology for replacing the Bendix adult salmon counters were conducted during 1998 and 1999 on the Wood River in the Bristol Bay management area. This clear water system provided an opportunity to operate experimental acoustic equipment in conjunction with a counting tower.

GOALS FOR SONAR TRANSITION

Central Region is moving forward with the process of replacing the six existing Bendix adult salmon sonar counters and the three existing Bendix smolt sonar systems. Transition to the new adult salmon counting equipment will take approximately four years for each project (Figure 2). The region's goal is to complete the replacement of these six counting systems in the next six years - FY 2003 through FY 2008 (Figure 3). This requires evaluating new sites or improving existing sites, training staff, testing old and new equipment side by side, evaluating the effect of new sites and equipment on escapement goals and inriver run goals, and making needed regulatory changes, if any.

Transition to new smolt counting sonar systems is expected to take three years for each system. The region's goal is to also have those three systems replaced during the six-year period FY 2003 through FY 2008. This document lays out the timeline and costs associated with this transition for each project in Central Region.

New generation adult salmon counting sonar systems are necessarily more complex than the Bendix sonar counters they are replacing. As a result, the data output and the time required to analyze that data have increased. With four such sonar systems in Upper Cook Inlet, a facility is needed to provide adequate lab and data processing space. The most logical location for such a facility is at the Kenai River sonar site located on Endicott Road in Soldotna. The current facility at this site is dilapidated and lacks the necessary office and lab space. The region's goal is to replace this ramshackle structure with a modern facility by FY 2005.

ADULT SALMON SONAR TRANSITION

Hydroacoustic technology permits enumeration of returning adult salmon in occluded waters such as the Copper, Kenai, Kasilof, Crescent, Yentna, and Nushagak rivers. In the department's Commercial Fisheries Division Central Region, hydroacoustic assessment of adult salmon escapement has evolved from upward-looking sonar arrays placed on the river bottom (Bendix Corporation, Electrodynamics Division 1968) to the side-looking,

Operational Timeline for Sonar Replacement

TASK	YEAR 1	YEAR 2	YEAR 3	YEAR 4
Site Evaluation	■			
Selection of System	■	■		
Site Improvements and Modifications		■	■	
Training Supervising Staff	■	■	■	
Training Technicians		■	■	■
Side By Side Testing		■	■	■
Correlation of Data Sets			■	■
Evaluation of Impacts to BEG, OEG or Inriver Goals			■	■
Regulatory Process				■
Public Education and Awareness	■	■	■	■

Figure 2. Operational timeline for sonar replacement.

Implementation Timeline for Sonar Replacement

SONAR PROJECT	FISCAL YEAR						
	2002	2003	2004	2005	2006	2007	2008
Copper River						1	
Kenai River							
Kasilof River							
Yentna River							
Crescent River							
Nushagak River							
Kvichak Smolt							
Egegik Smolt							
Ugashik Smolt							

 = First year of use for management

Figure 3. Implementation timeline for sonar replacement.

shore-based Bendix sonar systems currently in operation in UCI (Davis 2000), the Copper River (Dunbar 1999), and Nushagak River (Miller 2000). These shore-based systems operate at 515 kHz and fast multiplex between two and four degree elements within a single beam transducer. The Bendix system “counts” fish by dividing all returning echoes larger than a critical threshold level by a preset echoes per fish criteria. Bendix operators adjust the ping rate of the counter until echoes tallied from an oscilloscope match the automated count to compensate for behavioral changes in migrating fish. These systems are easy to use, portable, and have had outstanding maintenance and troubleshooting support. However, the Bendix Corporation no longer manufactures or supports these systems and spare parts are no longer manufactured. The designer, Mr. Al Menin, is currently contracted by the State of Alaska for preseason calibration and testing, but he is considering retirement in the near future. Therefore, the State of Alaska is in the process of developing a new prototype state-of-the-art sonar system to replace the Bendix counters.

Investigation of available technologies and working with vendors to develop new technology to replace the Bendix units began in 1998. As a result of this effort plans have been made to replace the Bendix systems with split beam sonar technology. The advantages of split beam over single beam or dual beam sonar systems are well documented (Ehrenberg and Torkelson 1996; Burwen et al. 1995, and Traynor and Ehrenberg 1990). Split beam sonar measures the position of targets in 3 dimensions, which allows individual targets to be tracked. Target tracking provides information to distinguish debris or random reverberation from fish and to distinguish upstream from downstream migration. It also enables measurement of fish swimming speed, distributions of fish within the beam, and more accurate estimates of target strength. Split beam sonar counters are currently used to enumerate king salmon *O. tshawytscha* on the Kenai River (Bosch and Burwen 1999) and chum salmon *O. keta* on the Chandalar River (Daum and Osborne 1998). These projects enumerate salmon by manually identifying the tracks of individual fish on an electronic echogram. This approach can provide accurate counts at low fish densities but is too time consuming to use at the higher densities typically encountered with sockeye salmon. Numerous overlapping fish traces are difficult to visually discern using single beam or split beam information and require a considerable amount of time to be counted manually. Therefore, the department has embarked on a contract with the Canadian Department of Fisheries and Oceans staff to develop software that automates tracking of fish targets.

This document lays out the funding needs over the next six years for replacement of Bendix adult salmon sonar counters on the Copper River at Miles Lake, in Upper Cook Inlet on the Kenai, Kasilof, Yentna, and Crescent Rivers, and in Bristol Bay on the Nushagak River near Portage Creek. The region’s goal is to complete the replacement of all these systems over the next six years. All dollar figures are in thousands of dollars. Total cost is anticipated to be \$2,592.4. This breaks down to \$668.0 for Copper River, \$1,509.2 for Cook Inlet, and \$415.2 for Bristol Bay. Of this total cost, \$1590.6 is currently unfunded and is being sought by the department.

PRINCE WILLIAM SOUND/COPPER RIVER

Copper River (Miles Lake) Sonar

Miles Lake sonar is located on the Copper River near the Million Dollar Bridge at Mile 49 of the Copper River Highway. The project is used primarily to count sockeye salmon and is the basis for management of the Copper River commercial and subsistence fisheries.

Development of the sonar replacement will take place during FY 2003 through FY 2005 (Table 1).

Work Completed to Date: river bottom profile, selection of a better site for the artificial substrate; contract for new substrate, and pouring new substrate.

FY 2002, remainder: no anticipated activity.

FY 2003: efforts will focus on purchasing the remaining equipment, finishing inriver testing; sonar data analysis equipment calibrations, and beginning comparison with the Bendix sonar.

FY 2004: efforts will focus on sonar data analysis and reporting, equipment calibrations, finishing the first, and beginning a second, season of Bendix comparison.

FY 2005: efforts will focus on continuing sonar data analysis and reporting, completing the second season of Bendix comparison, and reassessing BEGs and inriver goals for new sonar system.

FY 2006: estimates from new sonar system will be used for inseason management.

Table 1. COPPER RIVER (MILES LAKE) ADULT SALMON SONAR FUNDING SUMMARY

	<u>Dollars</u>	<u>Funding Source</u>
Expenditure as of 12/30/01	257.0	CIP & USFS
Projected Expenditures For		
Remainder FY 2002	15.0	USFS
Projected Expenditures FY 2003	212.0	
Projected Expenditures FY 2004	129.0	
Projected Expenditures FY 2005	<u>55.0</u>	
Projected Total Project Expenditures	668.0	
Amount of Project Unfunded	396.0	
Year Anticipated For Inseason Management Use = FY 2006		

UPPER COOK INLET

Kenai River Sonar

Kenai River sonar is located on the Kenai River at river mile 19, just downstream of the Sterling Highway Bridge in Soldotna. The project counts sockeye salmon and is the basis for management of the Kenai River sport and personal use fisheries as well as an integral part of the management of the Upper Cook Inlet commercial fishery.

Development of the sonar replacement will take place during FY 2002 through FY 2004 (Table 2).

Work Completed to Date: river bottom profile, equipment purchase; and test of new equipment inriver.

FY 2002, remainder: efforts will focus on sonar data analysis and reporting, equipment calibrations, and starting the first year of comparison with Bendix sonar counter.

FY 2003: efforts will focus on sonar data analysis and reporting, equipment calibrations, equipment calibrations, finishing the first year of comparison with the Bendix sonar, and starting a second year of Bendix comparison.

FY 2004: efforts will focus on sonar data analysis and reporting, equipment calibrations, finishing the second season of Bendix sonar comparison, reassessing BEGs and inriver goals for new sonar system.

FY 2005: estimates from the new sonar system will be used for inseason management.

Table 2. KENAI RIVER ADULT SALMON SONAR FUNDING SUMMARY

	<u>Dollars</u>	<u>Funding Source</u>
Expenditure as of 9/15/01	213.0	CIP
Projected Expenditures For		
Remainder FY 2002	72.0	CIP
Projected Expenditures FY 2003	53.0	
Projected Expenditures FY 2004	<u>50.0</u>	
Projected Total Project Expenditures	388.0	
Amount of Project Unfunded	103.0	
Year Anticipated For Inseason Management Use = FY 2005		

Kasilof River Sonar

The Kasilof River sonar is located at river mile 10.5 on the Kasilof River, immediately upstream of the Sterling Highway Bridge. The sonar counts sockeye salmon and is the basis of determining if BEGs are met and is an integral part of managing the Upper Cook Inlet commercial fishery, especially in the Kasilof Section.

Development of the sonar replacement will take place during FY 2003 through FY 2005 (Table 3).

Work Completed to Date: low water river survey, bottom profile, selection of two sites, and partial equipment purchase.

FY 2002: no anticipated activity

FY 2003: efforts will focus on new site selection, negotiating land agreements, purchasing remaining equipment; testing the new equipment inriver; sonar data analysis and reporting, equipment calibrations, first year of comparison with the Bendix sonar.

FY 2004: efforts will focus on sonar data analysis and reporting, equipment calibrations, finishing the first season and starting a second season of Bendix sonar comparison, reassessing species apportionment program.

FY 2005: efforts will focus on sonar data analysis and reporting, equipment calibrations, finishing the second season of Bendix sonar comparison, reassessing BEGs and inriver goals for new system.

FY 2006: estimates from new system will be used for inseason management.

Table 3. KASILOF RIVER ADULT SALMON SONAR FUNDING SUMMARY

	<u>Dollars</u>	<u>Funding Source</u>
Expenditure as of 9/15/01	28.0	CIP
Projected Expenditures For Remainder FY 2002	0.0	
Projected Expenditures FY 2003	160.0	
Projected Expenditures FY 2004	50.0	
Projected Expenditures FY 2005	50.0	
Projected Expenditures FY 2006	<u>50.0</u>	
 Projected Total Project Expenditures	 338.0	
 Amount of Project Unfunded	 310.0	
 Year Anticipated For Inseason Management Use = FY 2006		

Yentna River Sonar

The Yentna River sonar is located on the Yentna River, approximately 4 river miles above its confluence with the Susitna River and approximately 30 miles upstream from saltwater. The project is used primarily to count sockeye salmon, but also counts significant numbers of pink and coho salmon. The number of sockeye passing the Yentna River counter is considered to be an index of the number of sockeye salmon entering the Susitna drainage, and therefore the counter is an integral part of Upper Cook Inlet commercial fishery management.

Development of the sonar replacement will take place during FY 2004 through FY 2007 (Table 4).

Work Completed to Date: preliminary bottom profile.

FY 2002: remainder: no anticipated activity.

FY 2003: no anticipated activity.

FY 2004: efforts will focus on continued bottom profiling (needed every year in this system), equipment purchase, and testing new equipment inriver.

FY 2005: efforts will focus on bottom profiling, finishing inriver sonar testing, sonar data analysis and reporting, equipment calibrations, starting the first season of Bendix sonar comparison.

FY 2006: efforts will focus on bottom profiling, sonar data analysis and reporting, equipment calibrations, finishing the first season and starting a second season of Bendix sonar comparison, reassessing species apportionment program.

FY 2007: efforts will focus on bottom profiling, sonar data analysis and reporting, equipment calibrations, finishing the second season of Bendix sonar comparison, reassessing BEGs and inriver goals for new sonar system.

FY 2008: estimates from the new sonar system will be used for inseason management.

Table 4. YENTNA RIVER ADULT SALMON SONAR FUNDING SUMMARY

	<u>Dollars</u>	<u>Funding Source</u>
Expenditure as of 9/15/01	0.8	GF
Projected Expenditures For		
Remainder FY 2002	0.0	
Projected Expenditures FY 2003	0.0	
Projected Expenditures FY 2004	300.8	
Projected Expenditures FY 2005	70.8	
Projected Expenditures FY 2006	55.0	
Projected Expenditures FY 2007	<u>55.0</u>	
 Projected Total Project Expenditures	 482.4	
 Amount of Project Unfunded	 481.6	
 Year Anticipated For Inseason Management Use = FY 2008		

Crescent River Sonar

The Crescent River sonar is located on the Crescent River near the outlet of Crescent Lake, approximately 1.5 miles upstream from salt water. The project counts sockeye salmon and assess whether Crescent River BEGs are met. Therefore it is an integral part of Upper Cook Inlet commercial fishery management, especially for areas in the southwestern portion of Upper Cook Inlet.

Development of the sonar replacement will take place during FY 2004 through FY 2007 (Table 5).

FY 2002: no anticipated activity

FY 2003: no anticipated activity

FY 2004: efforts will focus on continued bottom profiling, equipment purchase, and testing new equipment inriver.

FY 2005: efforts will focus on finishing inriver sonar testing, sonar data analysis and reporting, equipment calibrations, starting the first season of Bendix sonar comparison.

FY 2006: efforts will focus on sonar data analysis and reporting, equipment calibrations, finishing the first season and a starting second season of Bendix sonar comparison, reassessing species apportionment program.

FY 2007: efforts will focus on sonar data analysis and reporting, equipment calibrations, finishing the second season of Bendix sonar comparison, reassessing BEGs and inriver goals for new sonar system.

FY 2008: use estimates from the new sonar system for inseason management.

Table 5. CRESCENT RIVER SONAR FUNDING SUMMARY

	<u>Dollars</u>	<u>Funding Source</u>
Expenditure as of 9/15/01	0.8	GF
Projected Expenditures For		
Remainder FY 2002	0.0	
Projected Expenditures FY 2003	0.0	
Projected Expenditures FY 2004	150.0	
Projected Expenditures FY 2005	50.0	
Projected Expenditures FY 2006	50.0	
Projected Expenditures FY 2007	<u>50.0</u>	
Projected Total Project Expenditures	300.8	
Amount of Project Unfunded	300.0	
Year Anticipated For Inseason Management Use = FY 2008		

BRISTOL BAY

Nushagak River Sonar

The Nushagak River sonar is located near Portage Creek on the Nushagak River. The project is used to count sockeye salmon, chinook salmon, and coho salmon. It is an integral part of management of the commercial salmon fisheries in the Nushagak District and the subsistence and recreational fisheries in the Nushagak River, especially for chinook salmon and coho salmon.

Development of the sonar replacement began in FY 2000 and will be completed during place during FY 2002 and FY 2003 (Table 6).

Work Completed To Date: river bottom profile, flow vector measurement and plot, equipment purchase; inriver test of the new equipment, and a one-bank comparison with Bendix sonar counter.

FY 2002, remainder: efforts focus on sonar data analysis, report preparation, purchasing remaining equipment; equipment calibrations, and a two-bank comparison with Bendix sonar counter.

FY 2003: efforts will focus on sonar data analysis and final report preparation, equipment calibrations, finishing the two-bank comparison with the Bendix sonar, reassessing species apportionment, and reassessing BEGs and inriver goals for new sonar system.

FY 2004: estimates from the new sonar system will be used for inseason management.

Table 6. NUSHAGAK RIVER SONAR FUNDING SUMMARY

	<u>Dollars</u>	<u>Funding Source</u>
Expenditure as of 9/15/01	263.2	WADG
Projected Expenditures For		
Remainder FY 2002	123.7	WADG
Projected Expenditures FY 2003	<u>28.3</u>	WADG
Projected Total Project Expenditures	415.2	
Amount of Project Unfunded	0.0	
Year Anticipated For Inseason Management Use = FY 2004		

ADULT SALMON SONAR SUMMARY

Converting existing Bendix sonar counters to new generation sonar counters is expected to cost \$2,592.4 (Table 7). Of this amount, \$1,590.6 is currently unfunded. In order to complete the sonar project, the department must seek this amount in the form of Capital Improvement Projects (CIPs). These CIPs would be spaced over a five-year period (2003 to 2007) (Table 8). By FY 2008 all six adult salmon sonar systems should be operational and should require little, if any additional CIP funding.

Table 7. CENTRAL REGION ADULT SALMON SONAR FUNDING SUMMARY

	<u>Dollars</u>	<u>Funding Source</u>
Expenditure as of 9/15/01	762.8	CIP = 288.0 WADG = 263.2 GF = 1.6
Projected Expenditures For Remainder FY 2002	210.7	CIP = 72.0 WADG = 123.7 USFS = 15.0
Projected Expenditures FY 2003	453.3	WADG = 28.3 Unfunded = 425.0
Projected Expenditures FY 2004	679.8	Unfunded = 679.8
Projected Expenditures FY 2005	225.8	Unfunded = 225.8
Projected Expenditures FY 2006	155.0	Unfunded = 155.0
Projected Expenditures FY 2007	<u>105.0</u>	Unfunded = 105.0
Projected Total Project Expenditures	2,592.4	
Amount of Project Unfunded	1,590.6	

Table 8. CENTRAL REGION ADULT SALMON SONAR CIP REQUESTS

FISCAL YEAR	AMOUNT OF CIP REQUEST	PROJECTS INCLUDED
2003	425.0	Copper, Kenai, Kasilof,
2004	679.8	Copper, Kenai, Kasilof, Yentna, Crescent
2005	225.8	Copper, Kasilof, Yentna, Crescent
2006	155.0	Kasilof, Yentna, Crescent
2007	105.0	Yentna, Crescent
TOTAL	1590.6	

JUVENILE SALMON (SMOLT) SONAR TRANSITION

In addition to counting adults, the region has operated a substantial sockeye salmon smolt counting program in Bristol Bay since 1971. Outmigrating smolts are counted as they pass over an upward looking transducer array on their way downstream from the rearing lakes in the Kvichak, Egegik, and Ugashik River drainages.

These smolt counters, also developed and constructed in the late 1970s and 1980s by Mr. Al Menin of Bendix, use the echo integration principle to estimate the biomass of smolts passing. Biomass is converted to numbers of smolts by dividing by the average weight of a smolt. These counters suffer from the same problems as the Bendix adult counters. In addition, these counters have difficulty dealing with situations where smolts are distributed very near the surface of the water, as they are at night when the largest numbers of smolt are migrating. Horizontal distribution of smolts may also be problematic since large portions of the river are not ensonified. Typically, three ten-foot wide arrays of transducers are spaced across the width of the river. Thus, smolt counts must also be expanded to account for unensonified areas by using linear interpolation.

This portion of the program is still under scientific investigation to determine the best equipment and counting methods. At the present time, the best replacement system appears to be a side-looking split beam sonar using echo integration to estimate biomass. Biomass would then be converted to numbers of smolt by using target strength measurements from single targets. A video calibration process is also being investigated as a means of corroborating these scaling factors. Once an acceptable counting system is developed, the department will be seeking funds to convert the three existing smolt-counting projects over to new equipment. This portion of the transition should be completed in FY 2007 (Figure 3).

Juvenile sockeye salmon (smolts) are counted as they outmigrate from three major river systems in Bristol Bay – the Kvichak, Egegik, and Ugashik Rivers. Accurate estimates of the number of outmigrating smolts are extremely valuable for understanding trends in ocean survival, evaluating the effects of various levels of escapement, and helping forecast adult returns. A 6-year program for transition to new sonar counting equipment is anticipated to cost a total of \$580.5 (Table 9). Of this amount, \$ 19.8 has been spent to date and \$560.7 remains unfunded.

KVICHAK RIVER SMOLT

Sockeye salmon smolts are counted in the Kvichak River at a site approximately 3.7 miles downstream of the village of Igiugig, which sits at the outlet of Lake Iliamna. The Kvichak River smolt sonar project has been under evaluation using funds from the Western Alaska Fishery Disaster project. This project is in the process of evaluating the present system, recommending a replacement system, and field testing the new system. Funding is needed to purchase additional equipment to complete the replacement of the Bendix gear and to compare smolt estimates from the new and old equipment. The replacement project would take two additional years. We anticipate using the new system for management by FY 2004.

Work Completed To Date: equipment purchase, onsite testing of equipment, preliminary evaluation regarding the most likely successful means of counting.

FY 2002: first year of comparison with Bendix smolt counter

FY 2003: second year of comparison with Bendix smolt counter.

FY 2004: estimates from new sonar system will be used for management.

EGEGIK RIVER SMOLT

Sockeye salmon smolts are counted in the Egegik River at a site approximately 2.5 miles downstream of the outlet of Lake Becharof. The replacement timeline is as follows:

FY 2003: purchasing equipment and onsite testing.

FY 2004: first year of comparison with Bendix smolt counter.

FY 2005: second year of comparison with Bendix smolt counter.

FY 2006: estimates from new sonar system will be used for management.

UGASHIK RIVER SMOLT

Sockeye salmon smolts are counted in the Ugashik River at a site located at the outlet of Lower Ugashik Lake. The replacement timeline is as follows:

FY 2005: purchasing equipment and onsite testing.

FY 2006: first year of comparison with Bendix smolt counter

FY 2007: second year of comparison with Bendix smolt counter.

FY 2008: estimates from new sonar system will be used for management.

Table 9. CENTRAL REGION JUVENILE SALMON SONAR FUNDING SUMMARY

PROJECT	<u>COST BY FISCAL YEAR</u>						
	2002	2003	2004	2005	2006	2007	2008
Kvichak River	19.8	58.5	13.0				
Egegik River		41.5	134.7	21.0	21.0	13.0	
Ugashik River				189.5	21.0	21.0	13.0
CIP REQUEST		100.0	161.2	210.5	42.0	34.0	13.0

KENAI RIVER SONAR CENTER

With the increased demands of developing modern acoustic technology to enumerate salmon escapements in the Kenai River, the department urgently needs a new facility at the Kenai River sonar site on Endicott Road (located at river mile 19, just downstream of the Sterling Highway bridge in Soldotna). A modern structure would replace the existing 1,200 square foot mobile home manufactured in 1970. This older facility is in disrepair, has become obsolete, and detracts from property values of surrounding houses. The new facility would be similar in appearance to homes on either side of the current structure. The new facility would be a center for processing acoustic databases collected from the Kenai River, the Kasilof River and potentially two other Cook Inlet sonar projects. The facility would contain an acoustic lab for maintenance and calibration of acoustic equipment. Living facilities would include two bedrooms, bathrooms and a kitchen.

Use of the existing facility as a bunkhouse and storage facility for all UCI sonar equipment, has increased greatly in recent years. Demand on this facility as a lab and data procession facility will increase as the new sonar systems replace the vintage Bendix sonar systems. This new structure would be approximately 2,500 square feet. Approximately 800 square feet would be allocated for lab and data processing space, 1,000 square feet for bunkhouse living space, 700 square feet of shop and fire resistant storage space for storing sonar equipment worth over 1 million dollars. This facility must have security and fire protection systems, and be wired for networking.

FY 2003 CIP request = \$325.0.

NOTE: a general fund increment will also be needed to maintain this facility. There is no maintenance done on the existing facility (except occasional work by sonar technicians).

SUMMARY

Replacement of the Central Region sonar inventory with up to date equipment is a critical component of improving management and research of salmon fisheries in Central Region. This program includes replacement of Bendix adult salmon counters on six river systems, replacement of juvenile salmon sonar counters on three river systems, and construction of a new sonar facility in Soldotna. Completing the program for this replacement, as laid out in this document will take from FY 2003 until FY 2008 before the last units are fully operational. Total cost of this program is \$3,497.9. So far \$1,021.60 has been spent or secured. \$2,476.3 is unfunded. The department will submit CIP requests over the next six years according to the schedule laid out in Table 10.

**Table 10. CENTRAL REGION SALMON SONAR CIP REQUEST
SUMMARY – ALL PROJECTS, FY 2003 THROUGH FY 2008.**

YEAR	ADULT FISCAL SONAR CIP REQUEST	SMOLT SONAR CIP REQUEST	KENAI RIVER SONAR CENTER CIP REQUEST	TOTAL
2003	425.0	100.0	325.0	850.0
2004	679.8	161.2		841.0
2005	225.8	210.5		436.3
2006	155.0	42.0		197.0
2007	105.0	34.0		139.0
2008		13.0		13.0
Total	1,590.6	560.7	325.0	2,476.3

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